

WRITTEN STATEMENT
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ENHANCING FIRE WEATHER PREDICTION AND COORDINATION

COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
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Chairman Lucas, Ranking Member Lofgren, and Members of the Committee, thank you for inviting GreenSight to testify today before the Committee on Science, Space, and Technology to discuss the innovative products and services provided by the commercial sector and how they can partner with the National Oceanic and Atmospheric Administration (NOAA) for the improvement of fire weather nowcasting and prediction. I am James Peverill, co-founder and Chief Executive Officer of GreenSight.

At the outset, I'd like to mention that it is a very exciting time in the United States for new and innovative technologies, especially for drone technologies, robotics and artificial intelligence. For both civil and defense applications, these systems are showing tremendous value. Whether it's the unmanned drone conducting missions on the surface of Mars, or military drones playing an increased role in our national security, these systems have a proven record for aiding government missions.

GreenSight is an innovative small business based in Boston, Massachusetts that specializes in exotic robotics systems for transformative business applications. Currently we are focused on several different markets, including agriculture, weather, and defense. We have several product lines, all based on a common platform of made in the USA hardware and software components that empower end users to solve their mission requirements, including:

- **TurfCloud** - TurfCloud is the leading digital platform for professional turf management globally, used by golf courses and sports fields through the US and the world for optimizing their labor, water and chemical usage. TurfCloud combines robotics with artificial intelligence tools that empower turf managers to improve their facilities using technology. Automated daily drones gather imagery analyzed by AI algorithms to control robotic mowers. The TurfCloud platform is also being utilized by vineyards and other agricultural customers and holds promise to give similar benefits to other farming end users as it does for turf.
- **WeatherHive** - WeatherHive is a weather measurement system that enables hyper precise forecasting utilizing swarms of Nano-Unmanned Aerial Vehicles (UAVs). WeatherHive is optimized for minimal size, weight, and production cost in large quantities. Each Nano-UAV weighs less than 150 grams, with a max span of 6" allowing swarms stored and carried in a compact, portable, dispensing canister. WeatherHive enables tactical users to gather global weather data in contested and friendly locations. For commercial applications it has potential to dramatically enhance the accuracy of severe weather forecasts including tornadoes and wildfires.
- **Autonomous Robotic Harvesting Systems** - GreenSight has developed large autonomous drones for trimming and harvesting tree grown crops, particularly palm oil fruits. These systems are designed for operation at vast scales, backed by GreenSight robotics technology, solving global labor shortages that threaten food supplies. GreenSight is planning to extend this technology to other applications such as roadside vegetation management and commercial tree trimming.
- **Mustang** – Mustang is a tactical Vertical Take-Off and Landing (VTOL) Small Unmanned Aircraft System (SUAS), a snap together system with open interfaces

designed to accept a variety of payloads. The modular VTOL SUAS capability supports payloads that enable multiple Concept of Operations (CONOPs) including Intelligence, Surveillance, and Reconnaissance (ISR), base security, Psychological Operations (PsyOps), Effects Delivery, and Comms Relay.

- **Hyper Enabled Autonomous Drone Suite (HEADS)** - The HEADS system is a small form-factor package of sensors and communication devices designed for swarm SUAS to scale the capabilities gap of autonomous sensing and collaborating. HEADS enables small unmanned robotics to operate at large scale in challenging environments, with applications for tactical and commercial systems.
- **OsmoGenSet** - Developed by GreenSight in partnership with the US Marine Corps, OsmoGenSet (OGS) is a hybrid electric generator system designed to power military expeditionary payload systems of the future as well as hybrid electric aircraft. OGS delivers breakthrough power density and efficiency at electric power levels of 5-50kW.

As it pertains to the mission of environmental prediction and today's hearing, GreenSight is currently collaborating with the Air Force Weather Service and Defense Innovation Unit using our WeatherHive System for prototype development. GreenSight's WeatherHive is a unique new sensing technology that uses swarms of nano-sized drones to directly measure atmospheric conditions. This system can sample up to 200 square miles per flight, generating a dense 3d cube of measurements. This technology was developed through a National Science Foundation (NSF) funded Small Business Innovation Research (SBIR), and has now been selected by the US Air Force and the Defense Innovation Unit for a prototype development contract and potential procurement. This selection was made under the "Peacetime Indications and Warning: Global Weather Sensing" Commercial Solutions Opening.

WeatherHive's sensing capabilities are highly unique, as there are no known technologies to directly sample the atmosphere over large areas at a reasonable cost. Weather balloons are used extensively to gather critical data used for weather forecasting, but are limited in that they can only capture data along a rising path, are fairly expensive per flight, and can only be used once leading to waste and pollution. Full size manned aircraft can and are used, but are highly cost prohibitive for gathering large amounts of data. Palm sized WeatherHive nano unmanned aircraft weigh under 150 grams and are extremely inexpensive and safe. They can fly up to 10 miles away in a single flight, automatically launching and landing into their "hive" for recharging and reuse. Dozens or hundreds can be used at once to gather large quantities of data regularly and inexpensively. Remotely deployable and disposable, WeatherHive is able to gather data in remote or contested areas, filling in gaps the USAF needs to properly forecast weather conditions and inform military decision makers.

WeatherHive data shows promise to enable new breakthroughs in weather forecasting and climate science. Armed with data from WeatherHive, weather forecasting models may be able to much more accurately predict tornado formation, severe storm behavior, wildfire movement and hurricane paths. It is a promising new tool against increasingly common severe weather conditions that cause property damage, injuries and deaths every year.

GreenSight is developing WeatherHive using a selection of technology building blocks from the company's robotics services platform, a suite of custom robotics hardware and software systems

that facilitate developing innovative and impactful robotics technologies operating out in the real world where conditions and connectivity are not assured. GreenSight has worked with over 100 government agencies and private companies to bring their robotics and AI visions to reality.

For the specific mission of fire weather, NOAA would benefit from an enhanced mission focus to improve their detection and forecasting capabilities. NOAA has historically established dedicated programs and offices that work on specific environmental phenomena, such as tornadoes and hurricanes. Increasing their work for fire weather on both research and operations would lead to improved monitoring and forecasting of these deadly and costly events.

As a commercial company, we feel we can assist NOAA with this mission by providing critical data that improves the accuracy and timeliness of information to inform the public and safeguard lives and property. Previously, our conversations with NOAA have been centered around other weather events such as tornadoes, but applications for fire weather are equally as beneficial if not more.

The unique aspects of fire events places an even greater emphasis on remote sensing. Fires are inherently dangerous and often happen in remote areas that are difficult to reach. Using sensing technologies such as drone swarms will allow NOAA to continuously monitor and collect various forms of useful data in a safe and efficient manner. The data collected by the WeatherHive system can be streamed in real time and used for both nowcasting of events and in forecasting prediction systems and models. The data that WeatherHive collects is also compatible with existing tools, so there will be minimal need to re-develop forecasting infrastructure to ingest these new types of data.

By establishing research partnerships, NOAA would be able to harness the ingenuity of American industry. These partnerships can be mutually beneficial and lead to breakthrough technologies that improve our scientific understanding of fire weather as well. Likewise, the establishment and coordination of mechanisms for commercial data buys would allow NOAA to quickly ingest new sources of data to improve prediction of fire weather events. GreenSight stands ready to assist and partner with NOAA to improve their mission requirements for both research and operations.

Lastly, an issue that must be addressed when moving these types of innovative technologies into wide-spread operational use is complying with the associated regulatory framework. Historically, The Federal Aviation Administration (FAA) has the regulatory authority to grant the use and restrictions of drones in the United States. Utilizing novel and unique use cases for drones means that the FAA needs to address potentially outdated federal regulations and look for creative solutions to allow for integration into both public and private missions. WeatherHive is designed to operate with minimal risk to aviators, people, and property, while promising to offer significant overall benefits to public safety. I look forward to working with the FAA to ensure that our progress on these technologies is not limited so that we can continue to partner with the federal government to improve mission success.

Mr. Chairman, Ranking Member, and Members of the Committee, thank you for the opportunity to testify before you today. I would be pleased to answer any questions you may have.